Extending the VSO to Incorporate Data Analysis Capabilities

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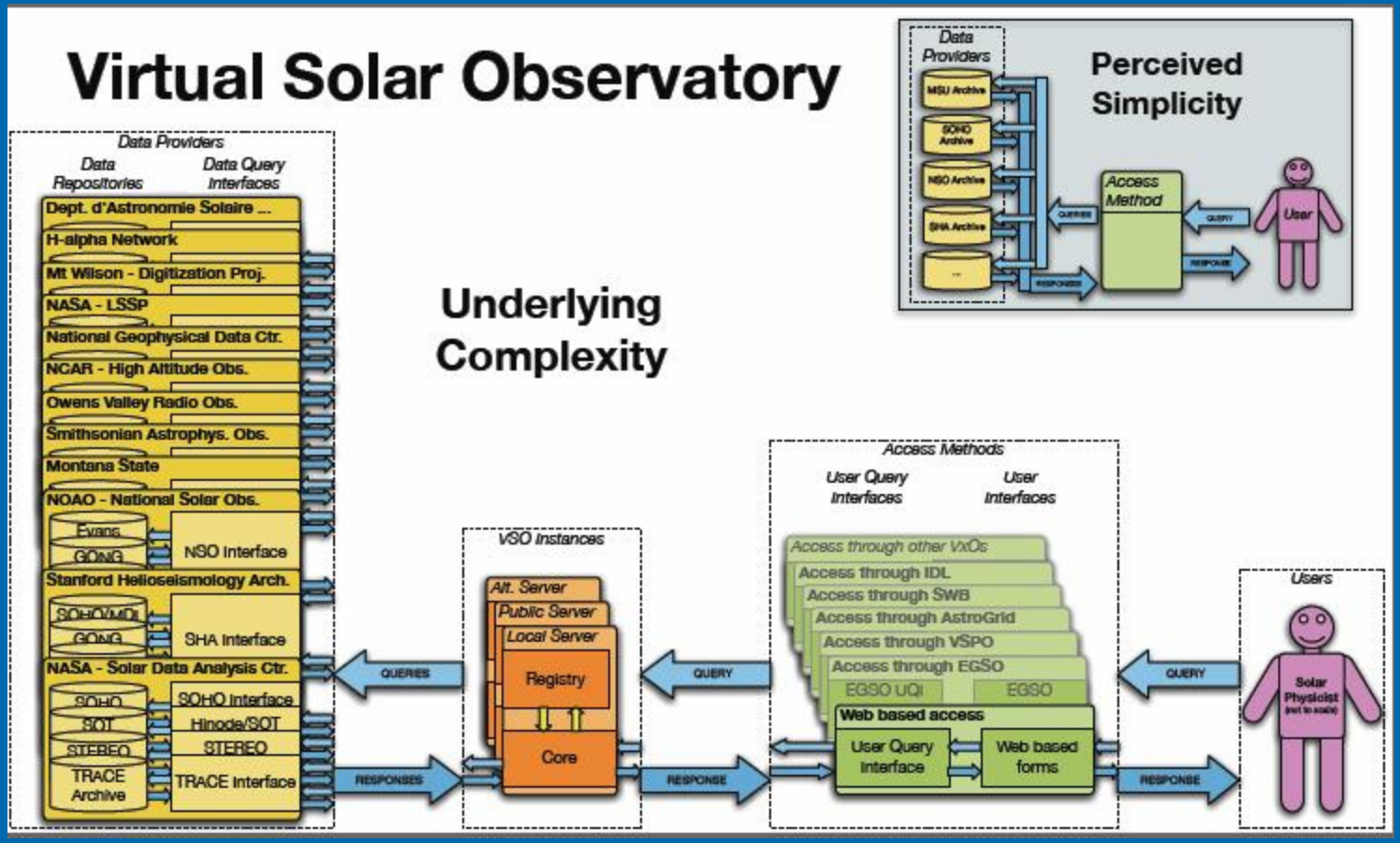
Outline

- The VSO IDL Client
- RHESSI Data Analysis Tools
- Extending the VSO to Data Analysis
- Summary and Future Plans

The VSO


Virtual Solar Observatory
Data Providers
Data Repositories
Data Query Interfaces
Dept. d'Astronomie Solaire ...
H-alpha Network
Mt Wilson - Digitization Proj.
NASA - LSSP
National Geophysical Data Ctr.
NCAR - High Altitude Obs.
Owens Valley Radio Obs.
Smithsonian Astrophys. Obs.
Montana State
NOAO - National Solar Obs.
Evans
GONG
NSO Interface
Stanford Helioseismology Arch.
SOHO/MDI
GONG
SHA Interface
NASA - Solar Data Analysis Ctr.
SOHO
SOT
STEREO
TRACE Archive
SOHO Interface
Hinode/SOT
STEREO
TRACE Interface
Underlying Complexity
QUERIES
RESPONSES
VSO Instances
Alt. Server
Public Server
Local Server
Registry
Core
QUERY
RESPONSE
Access Methods
User Query Interfaces
User Interfaces
Access through other VxOs
Access through IDL
Access through SWB
Access through AstroGrid
Access through VSPO
Access through EGSO
EGSO UQI
EGSO
Web based access
User Query Interface
Web based forms
QUERY
RESPONSE
Users
Solar Physicist
Data Providers
MSU Archive
SOHO Archive
NSO Archive
SHA Archive
Perceived Simplicity
Access Method
User
QUERIES
QUERY
RESPONSE

VSO IDL Client

- An Application Programming Interface (API) written in Interactive Data Language (IDL)
- Uses SOAP/XML & HTTP/POST/GET to query VSO registry and retrieve matching datasets from providers
- IDL> records=vso_search (tstart, tend, inst=inst, det=det, wave=wave)
- IDL> vso_get,records

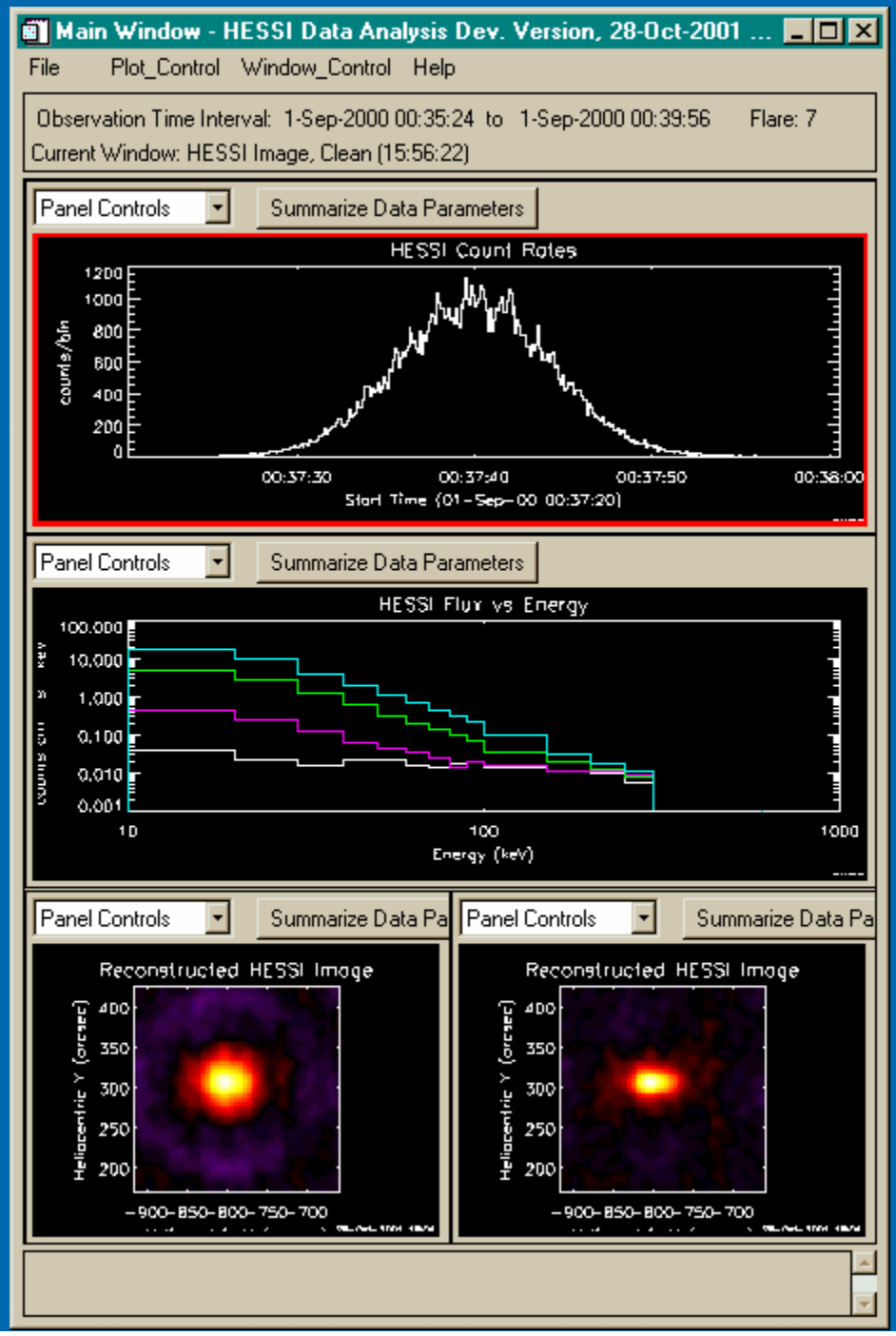
VSO IDL Client

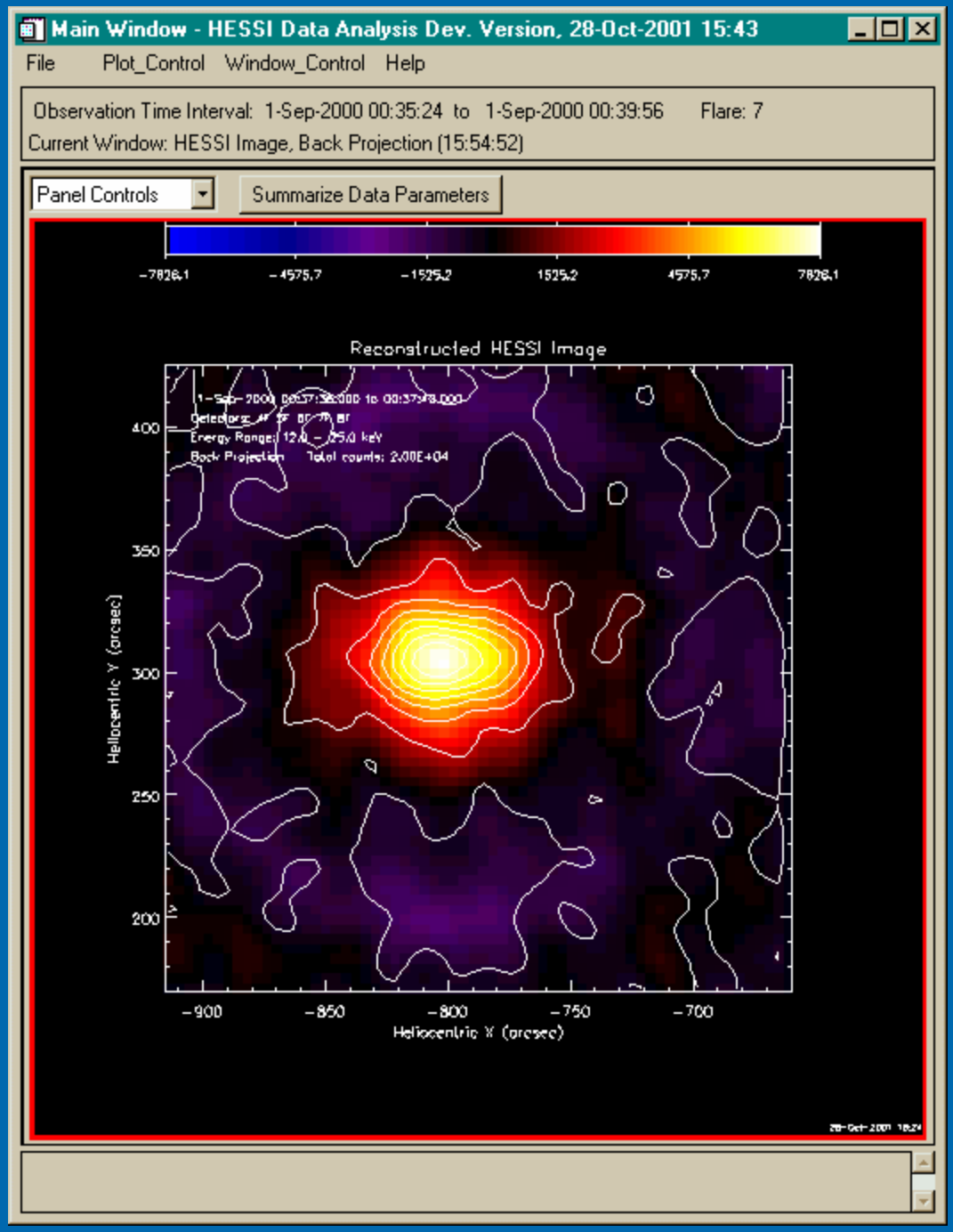
- The VSO IDL client is a simple tool for accessing the VSO
- It is supported on different OS/platforms (Windows, Mac OS X, Unix/Linux) and is available in SolarSoft
- More details at:

  "Callable Virtual Observatory Functionality: Sample Use Cases," Gurman et al., poster SH51A-0259

RHESSI Data Analysis Tools

- Graphical User Interface (GUI) for analyzing RHESSI observations (PLOTMAN)
- Object-oriented, IDL-based
- Read, process, and display RHESSI images, spectra, and lightcurves
- Makes heavy use of complementary observations for joint data analysis
- A mature application for applying and testing VSO concepts

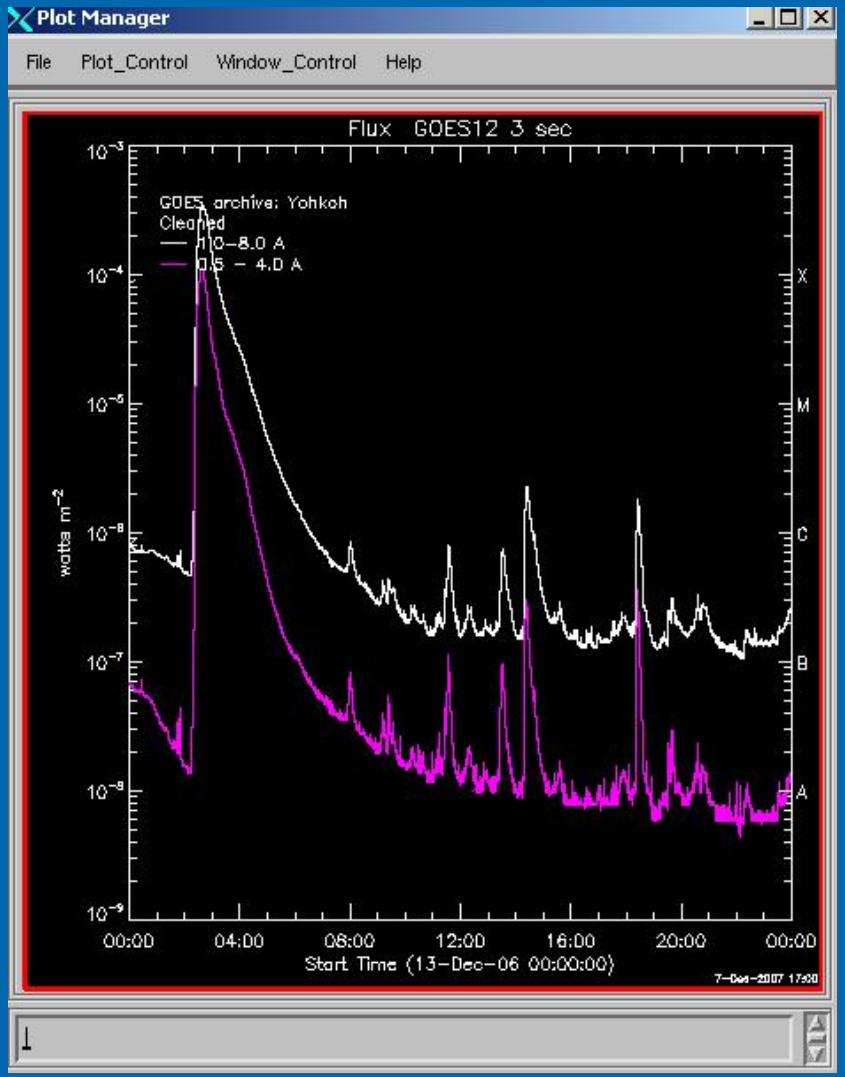

Main Window - HESSI Data Analysis Dev. Version, 28-Oct-2001 ...
File
Plot_Control
Window_Control
Help
Observation Time Interval: 1-Sep-2000 00:35:24 to 1-Sep-2000 00:39:56 Flare: 7
Current Window: HESSI Image, Clean (15:56:22)
Panel Controls
Summarize Data Parameters
HESSI Count Rates
counts/bin
1200
1000
800
600
400
200
0
00:37:30
00:37:40
00:37:50
00:38:00
Start Time (01-Sep-00 00:37:20)
Panel Controls
Summarize Data Parameters
HESSI Flux vs Energy
100.000
10.000
1.000
0.100
0.010
0.001
10
100
1000
Energy (keV)
Panel Controls
Summarize Data Pa
Reconstructed HESSI Image
Heliocentric Y (arcsec)
400
350
300
250
200
-900
-850
-800
-750
-700
Panel Controls
Summarize Data Pa
Reconstructed HESSI Image
Heliocentric Y (arcsec)
400
350
300
250
200
-900
-850
-800
-750
-700

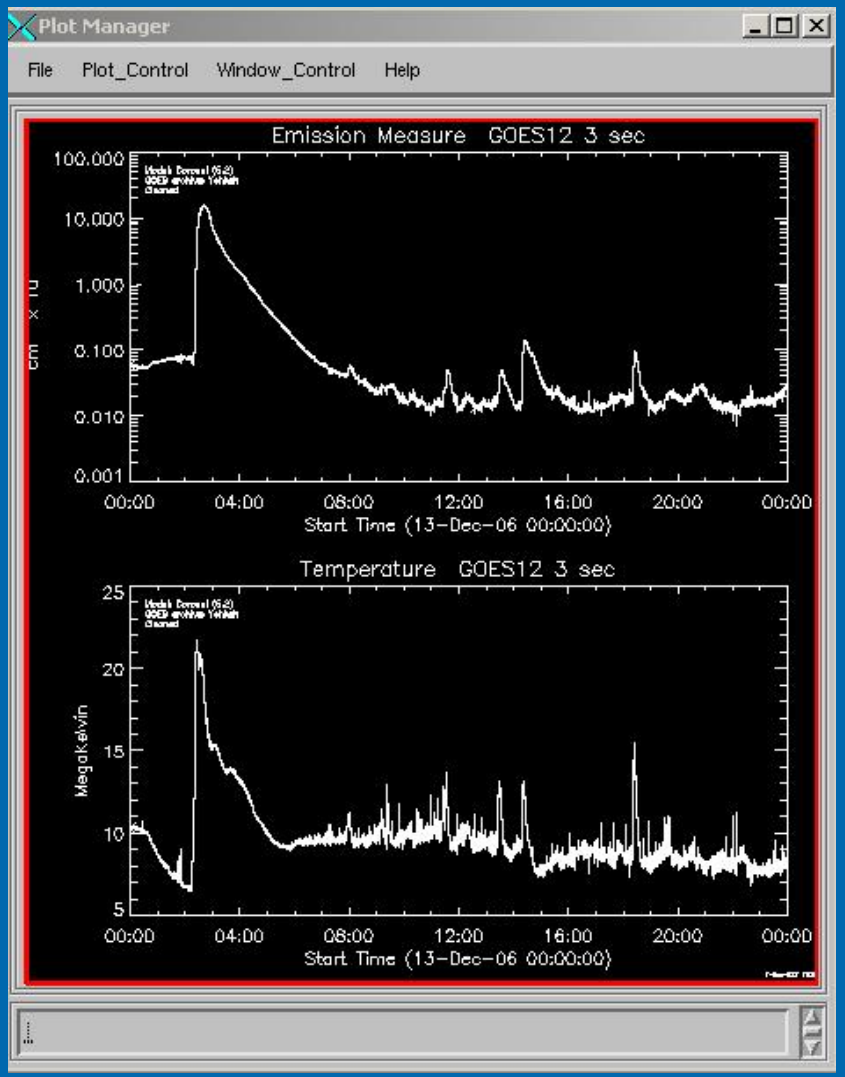

Main Window - HESSI Data Analysis Dev. Version, 28-Oct-2001 15:43
File
Plot_Control
Window_Control
Help
Observation Time Interval: 1-Sep-2000 00:35:24 to 1-Sep-2000 00:39:56 Flare: 7
Current Window: HESSI Image, Back Projection (15:54:52)
Panel Controls
Summarize Data Parameters
-7826.1
-4575.7
-1525.2
1525.2
4575.7
7826.1
Reconstructed HESSI Image
Energy Range: 12.0 - 25.0 keV
Back Projection
Total counts: 2.00E+04
400
350
300
250
200
Heliocentric Y (arcsec)
-900
-850
-800
-750
-700
Heliocentric X (arcsec)

Incorporating Data Analysis

- PLOTMAN has evolved from a RHESSI-specific data analysis tool to a general-purpose data analysis package
- Our goal: combine the VSO IDL client with PLOTMAN
- Our approach: use IDL objects as the “glue” to link VSO with data analysis tools

Lightcurves: Overlays





Spectrograms: Display

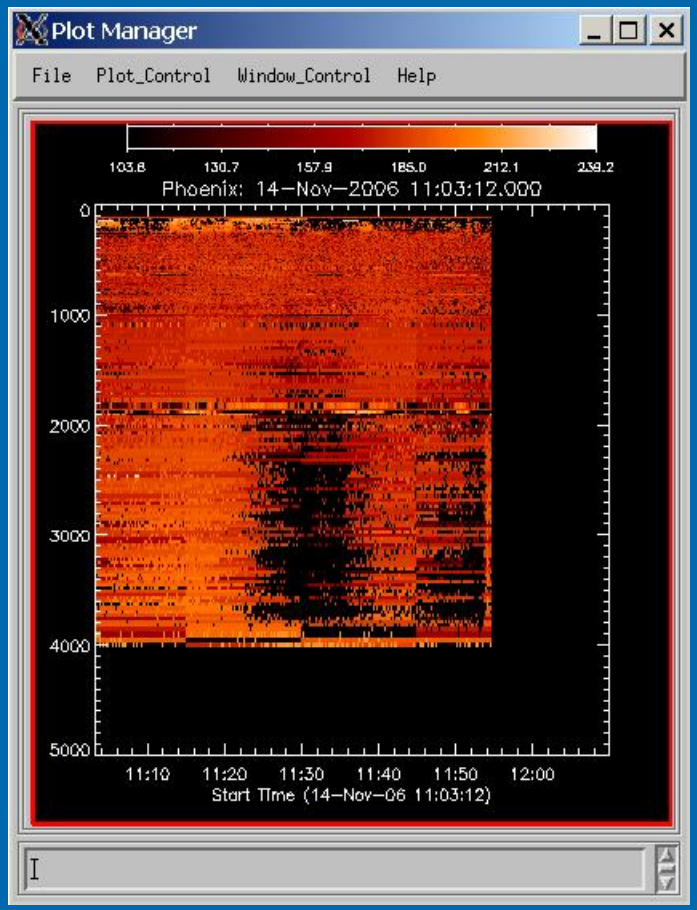
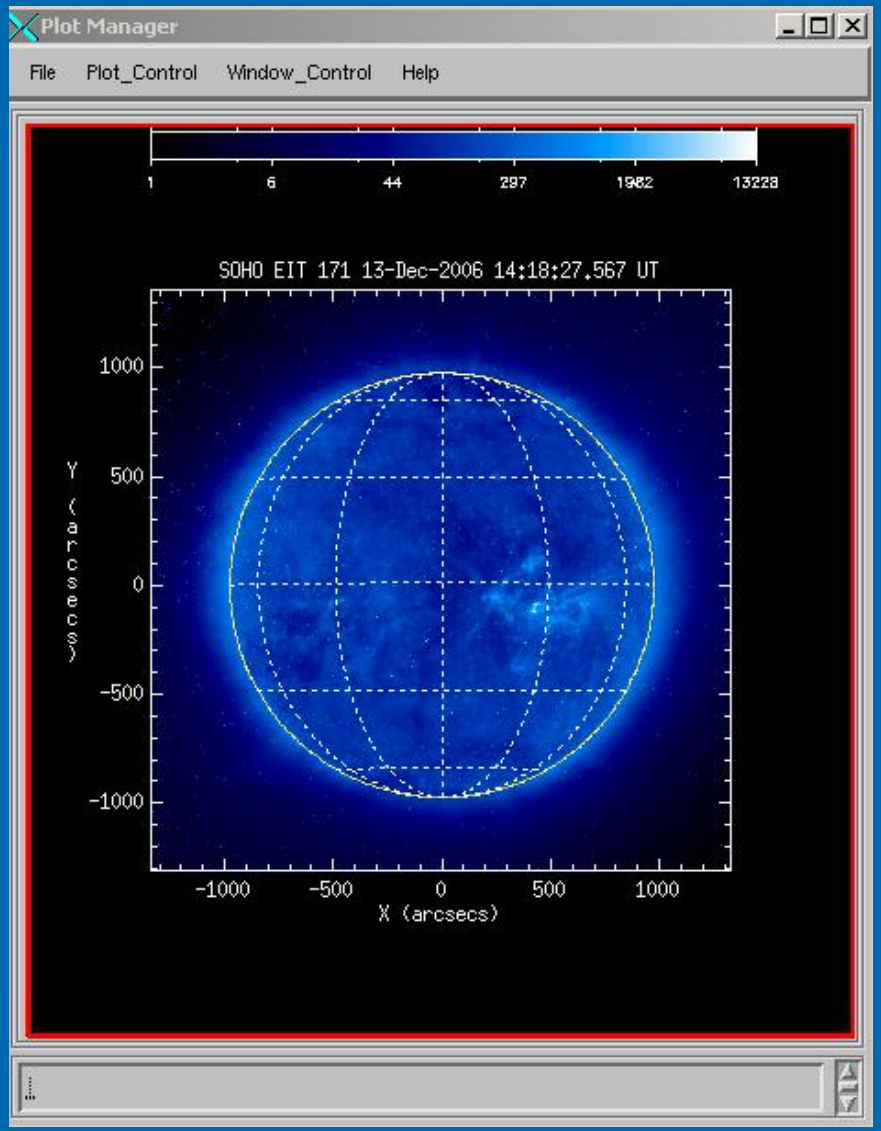


Image Processing: Zooming



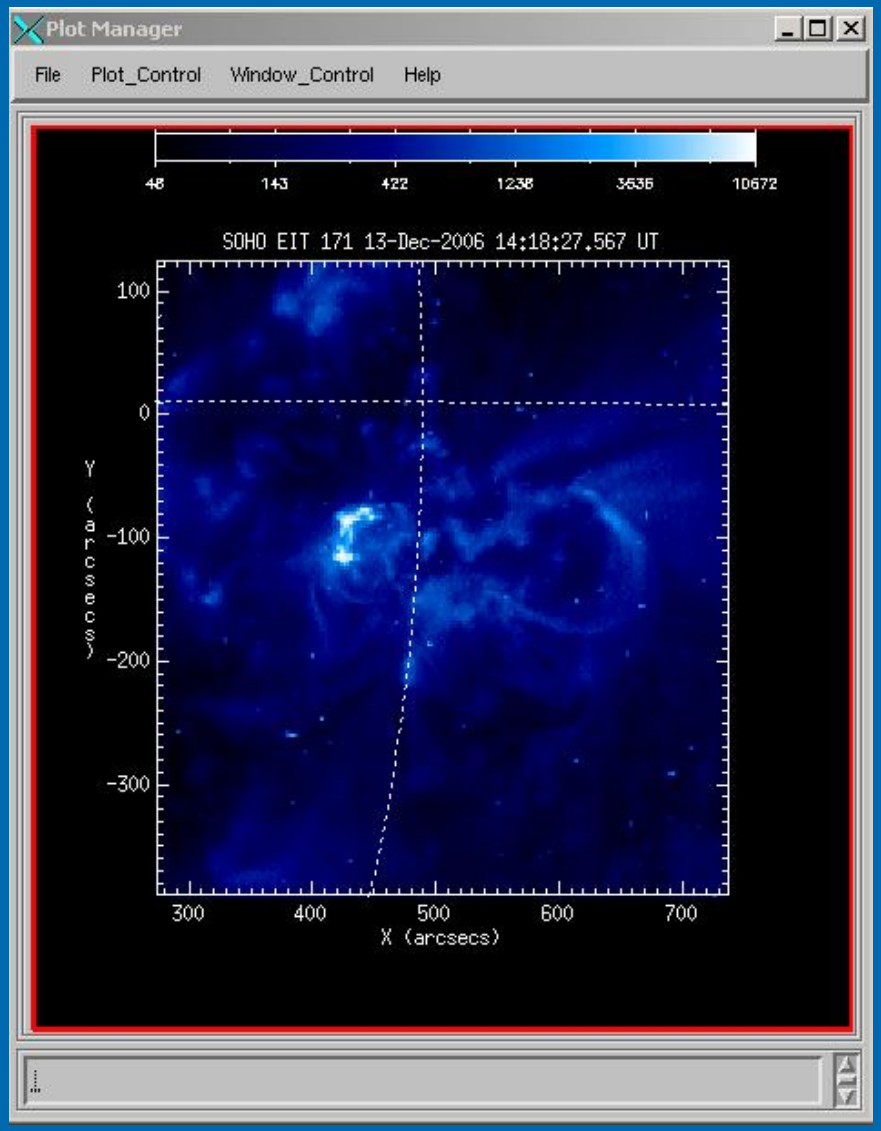
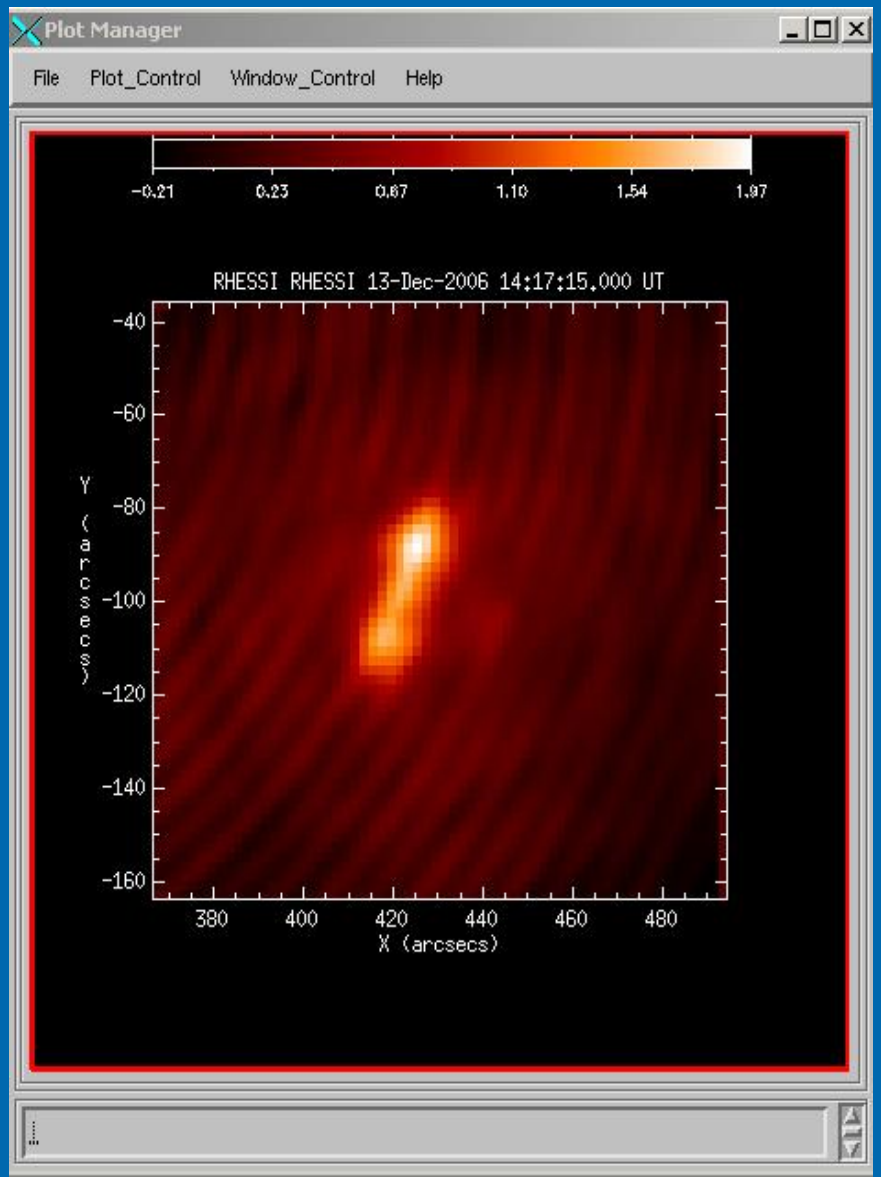
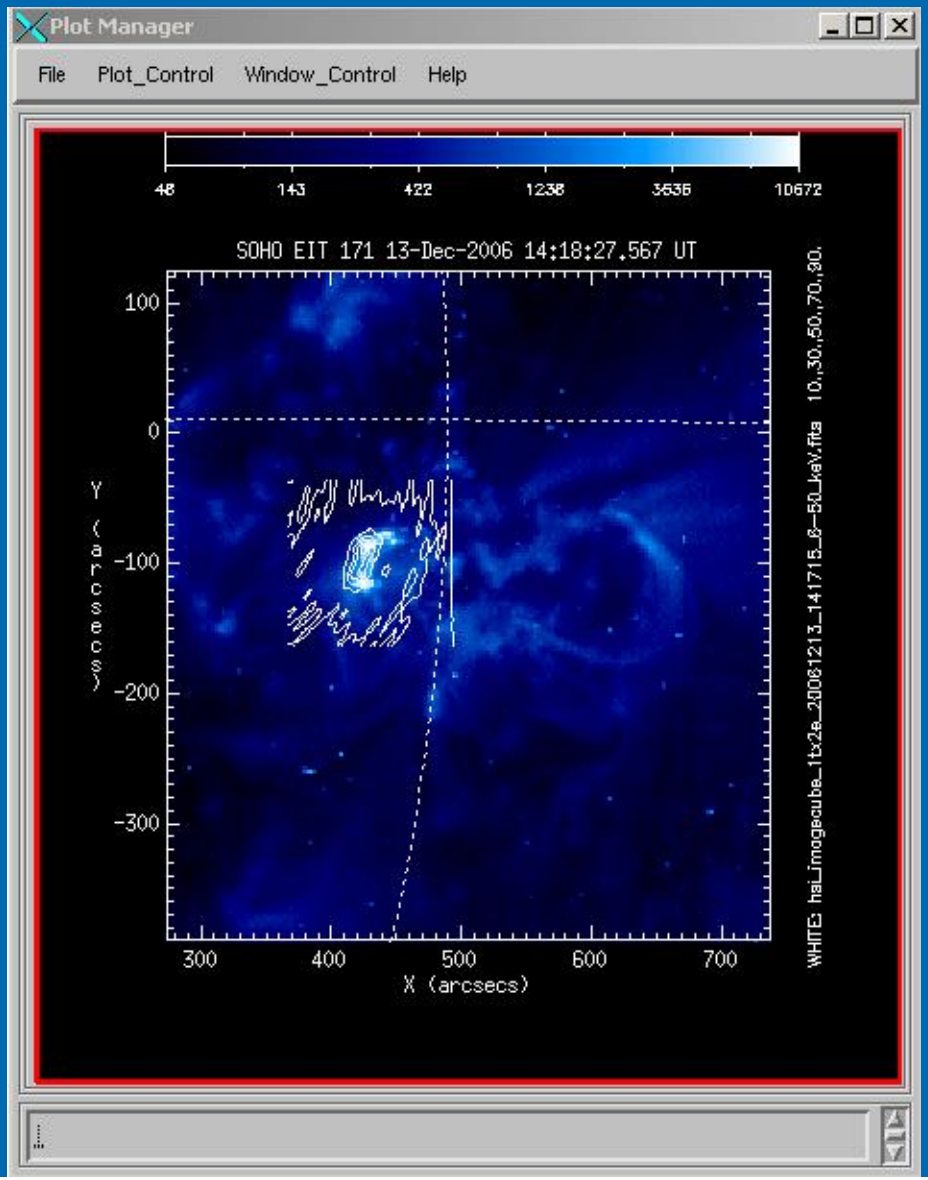


Image Processing: Co-registration





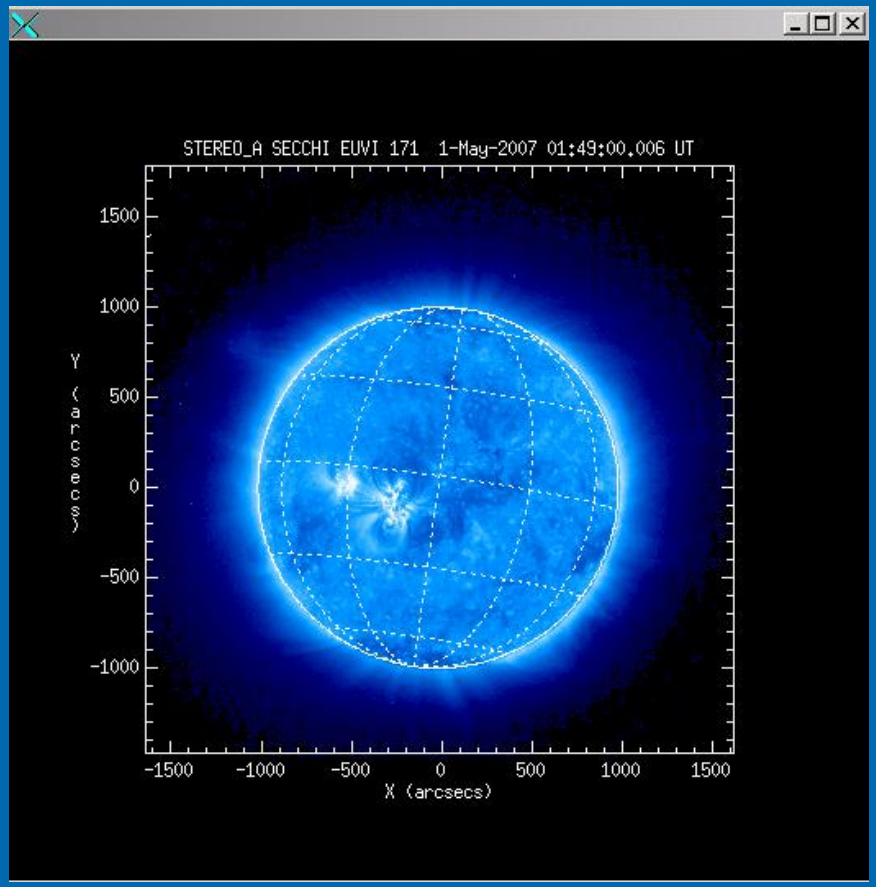
Advantages of Objects

- Shield the user from instrument details
- Provide a uniform interface for analyzing data
- Can be integrated into existing applications

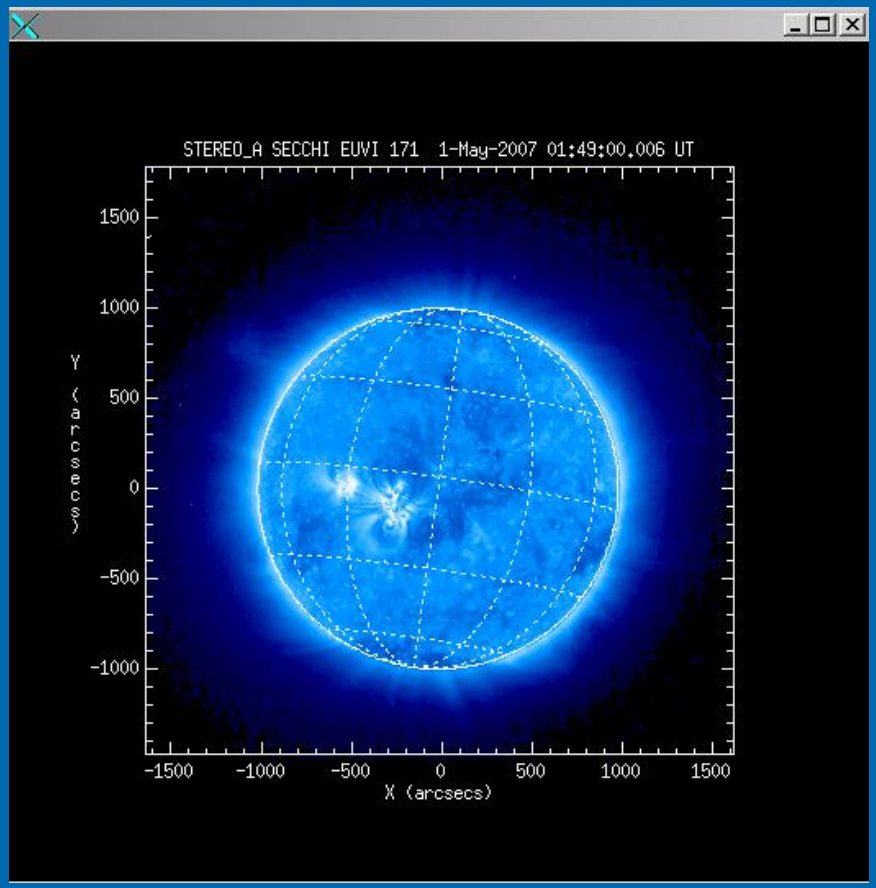
STEREO Object Example

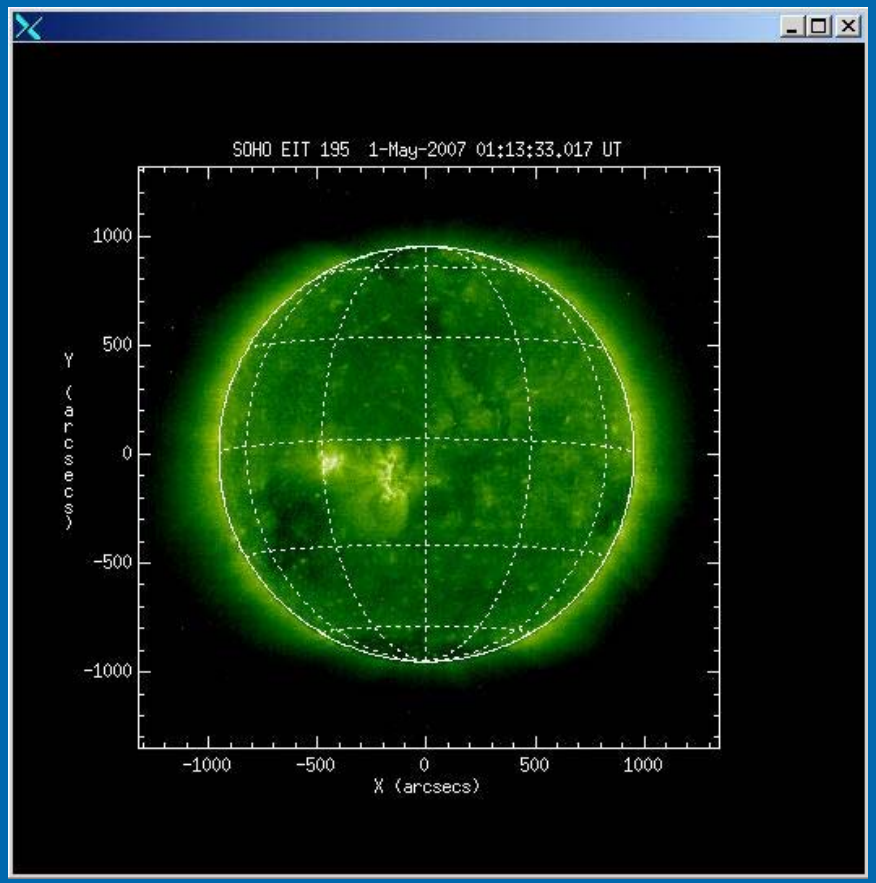
```
IDL> obj=obj_new('secchi')

IDL> files= obj->search('1-May-2007', '1-May-2007 01:00',
     inst='EUVI')

IDL> print,files[0]
     http://stereossc.nascom.nasa.gov/data/ins_data/secchi/L0/
     b/img/euvi/20070501/20070501_000400_n4euB.fts

IDL> obj->read,files[0]

IDL> obj->plot
```

Access STEREO Data

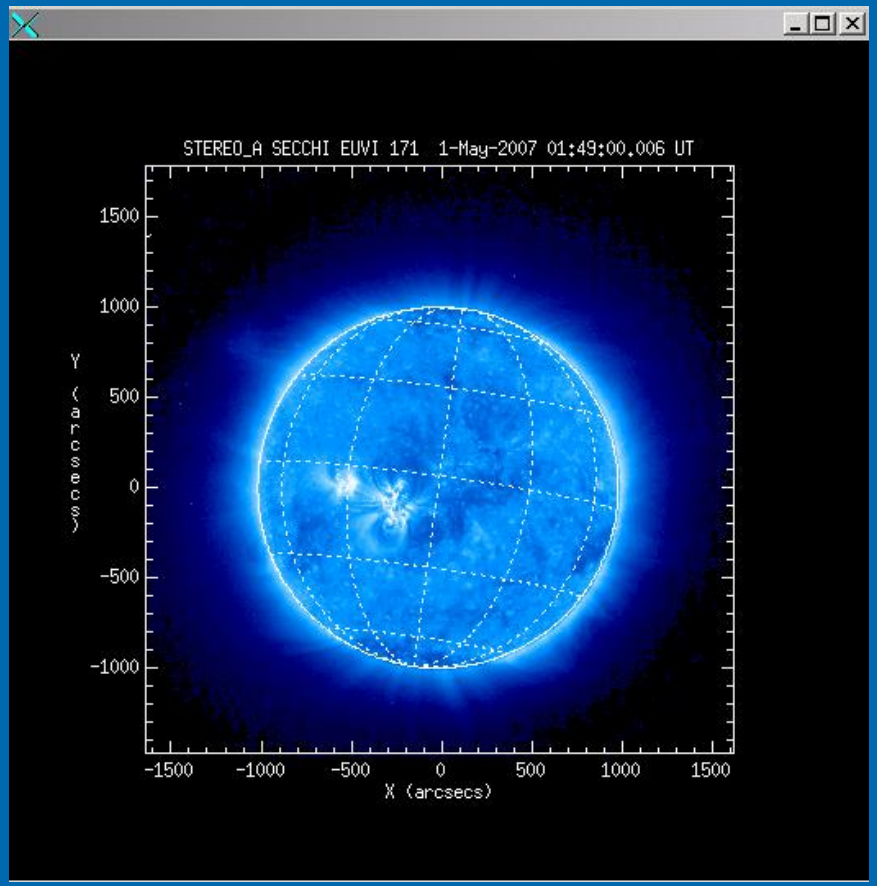


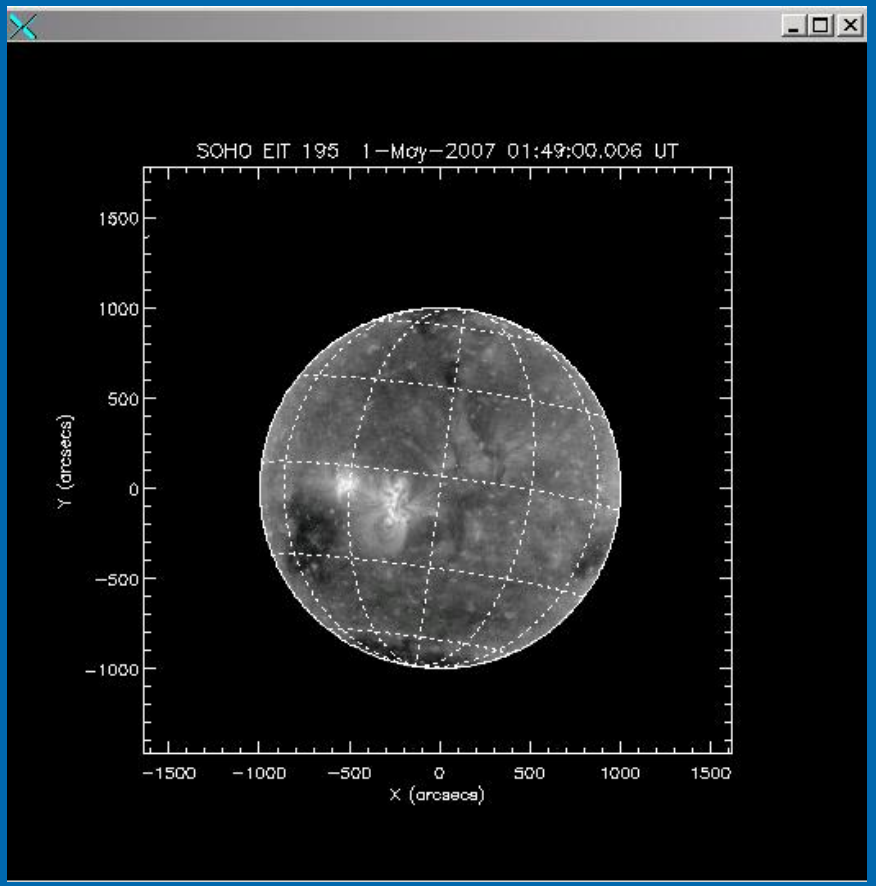
Compare SOHO and STEREO

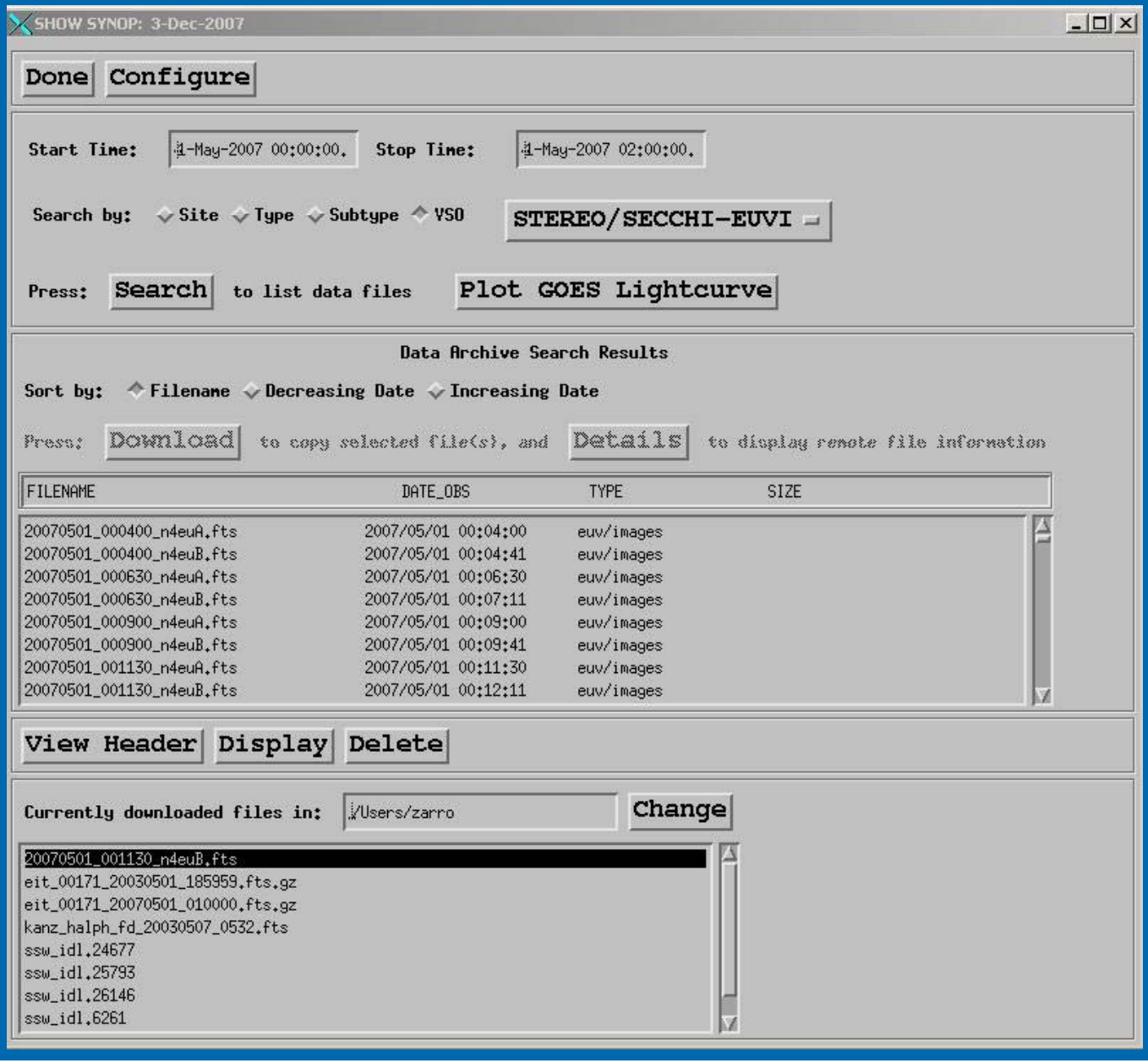




Project SOHO to STEREO View






SHOW SYNOP: 3-Dec-2007
Done
Configure
Start Time:
1-May-2007 00:00:00.
Stop Time:
1-May-2007 02:00:00.
Search by:
Site
Type
Subtype
VSO
STEREO/SECCHI-EUVI
Press:
Search
to list data files
Plot GOES Lightcurve
Data Archive Search Results
Sort by:
Filename
Decreasing Date
Increasing Date
Press:
Download
to copy selected file(s), and
Details
to display remote file information
FILENAME DATE_OBS TYPE SIZE
20070501_000400_n4euA.fts 2007/05/01 00:04:00 euv/images
20070501_000400_n4euB.fts 2007/05/01 00:04:41 euv/images
20070501_000630_n4euA.fts 2007/05/01 00:06:30 euv/images
20070501_000630_n4euB.fts 2007/05/01 00:07:11 euv/images
20070501_000900_n4euA.fts 2007/05/01 00:09:00 euv/images
20070501_000900_n4euB.fts 2007/05/01 00:09:41 euv/images
20070501_001130_n4euA.fts 2007/05/01 00:11:30 euv/images
20070501_001130_n4euB.fts 2007/05/01 00:12:11 euv/images
View Header
Display
Delete
Currently downloaded files in:
/Users/zarro
Change
20070501_001130_n4euB.fts
eit_00171_20030501_185959.fts.gz
eit_00171_20070501_010000.fts.gz
kanz_halph_fd_20030507_0532.fts
ssw_idl.24677
ssw_idl.25793
ssw_idl.26146
ssw_idl.6261

Summary

- RHESSI PLOTMAN is a general purpose package for analyzing multi-wavelength and -dimensional datasets
- Incorporating the VSO IDL client into packages such as PLOTMAN extends the data analysis capability of the VSO
- We are currently adding new mission datasets (STEREO, Hinode) to further extend this capability

Future Plans

- Extend VSO IDL Client capabilities to other Solar projects
- Integrate with other VxO's to access non-Solar datasets
- Explore open source alternatives (e.g. GDL) for non-IDL users
- Still a lot of work to do….